

User's Manual For CT Model IMB



Contents:

A. Introduction	3
B. Steps on receipt and opening the cases	3
C. Transportation and handling	3
D. Unpacking the transformer.....	4
E. Storage	6
F. Installation.....	7
G. Final inspection after installation	10
H. Normal Controls and Maintenance	11
Attachment: Types and plan for necessary inspections and controls.....	13



A. Introduction

The current transformers model IMB are outdoor type CTs which are designed, manufactured and delivered from 72 kV up to 245 kV. The model can be divided into the two types of IMBD and IMBE (the one with normal expansion tank and the one with corrugated expansion tank).

The model, depended on order, can include protective or measuring cores or both of them. The main parts of the model are:

- Oil tank made from galvanized steel.
- Insulator of porcelain in brown or grey color
- Expansion tank holding nitrogen gas made from galvanized steel.
- Primary terminals made from electroplated copper.
- Primary winding made from aluminum or copper.
- Cores made from grain oriented or my metal.
- Secondary windings made from double enamelled wires.

The model can be designed and manufactured up to 4000 A primary current. The secondary current can be 1, 2 or 5 A. In special orders, the secondary current can be different.

B. Steps on receipt and opening the cases

The first step is opening the cases. So, by full inspection, get sure that the cases are not damaged during transportation. Then check that no cracking on the insulator and no sign of oil leakage can be seen on the surface of transformer specially on the joint between insulator and expansion tank and oil tank.

In case any defect as above is seen, the subject shall be documented in writing with photos of the defected area. Then, the insurance company and Nirou Trans Co. shall be informed.

The instruction for unpacking and lifting the transformers with crane are fixed on the inner side of the package.

C. Transportation and Handling

The model of CT can be transported in two ways:

C.1. Horizontal transportation:

All the sizes of IMBD and some types of IMBE 72, 145 which are designed suitably, can be transported horizontally. All IMBE 245 shall be transported horizontally.

If an IMB is transported horizontally, attention shall be payed to the sign of upside direction on the transformer.



C.2. Vertical transportation

The models IMBE 72, 145 if not designed for horizontal transport, shall be transported vertically. In this case, the maximum inclination angle from vertical axis is 60°.

In case any transformer designed for vertical transportation is, by mistake, put in horizontal position, it shall not be put into service, because the nitrogen gas inside the expansion tank may have entered the space of the active part.

In this case, there is a risk of explosion, if the transformer is put in service. So, before taking any action, please contact the sales department of Nirou Trans Co.

D. Unpacking the transformer

The steps for unpacking the transformers will be different as follow:

D.1. The transformers which have been transported horizontally

The upper part of the package is opened and the transformer is brought out as shown in figure No. 1.A.

It is recommended emphatically that the cotton belt used in this action shall be connected to the upper part of the porcelain and not between the sheds. Otherwise, the insulator may be damaged. Chain shall not be used to avoid damaging the insulator.

As shown in figure 1.B, after bringing out the transformer and laying it on the ground, by connecting a belt to the upper part of the insulator, the transformer is relocated into vertical position.

Thereafter, the transportation of the transformer shall be in vertical position.

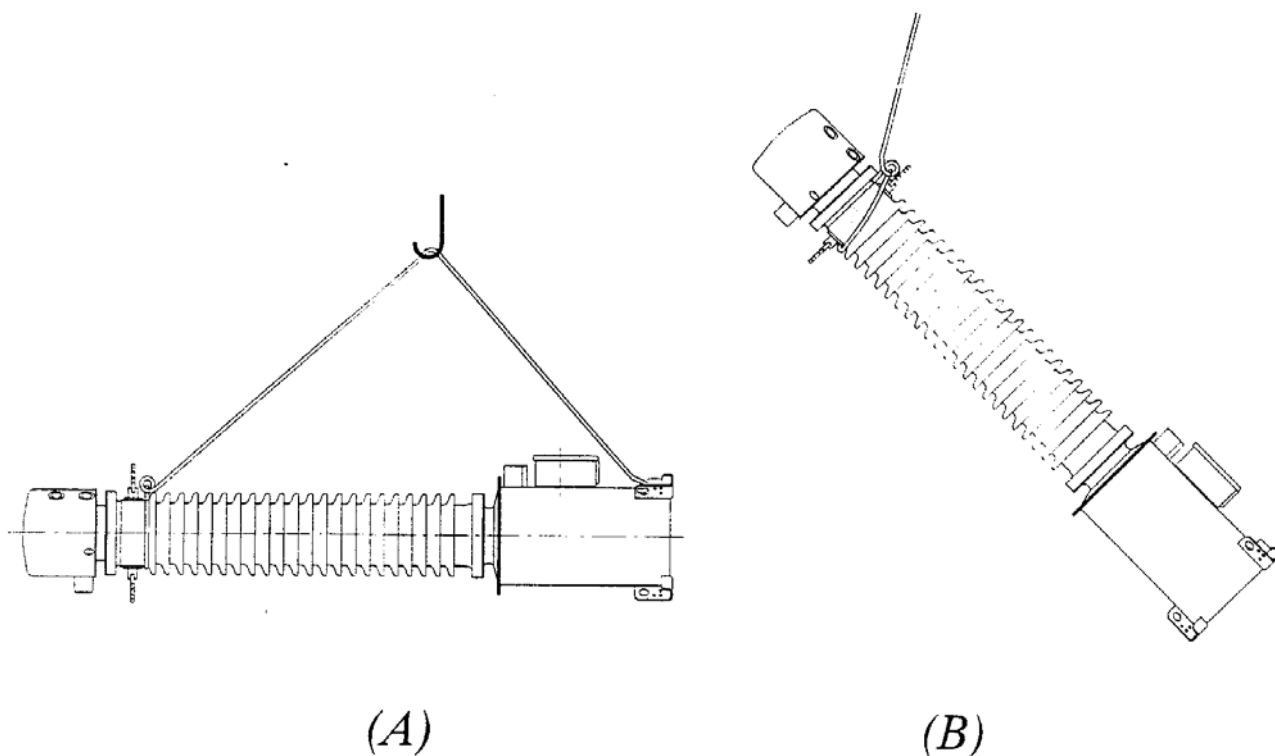


Figure No. 1

D.2. The transformers that have been transported vertically or have been relocated into vertical position after horizontal position as in item D.1. :

In this case, the cotton belt is used too. The connection points of the belts to the transformer are prepared on the bottom of the oil tank and are 4 plates welded to the walls of the oil tank, each including a hole for the hooks of the belts. After connecting the hooks of the belts to the plates, it is necessary to turn the belts twice around the transformer so that the primary terminals are located between cross passing of the belts from two sides and the transformer is balanced during lifting.

In figure 2, the method of connecting the belts and hooks to the transformer before lifting is shown.

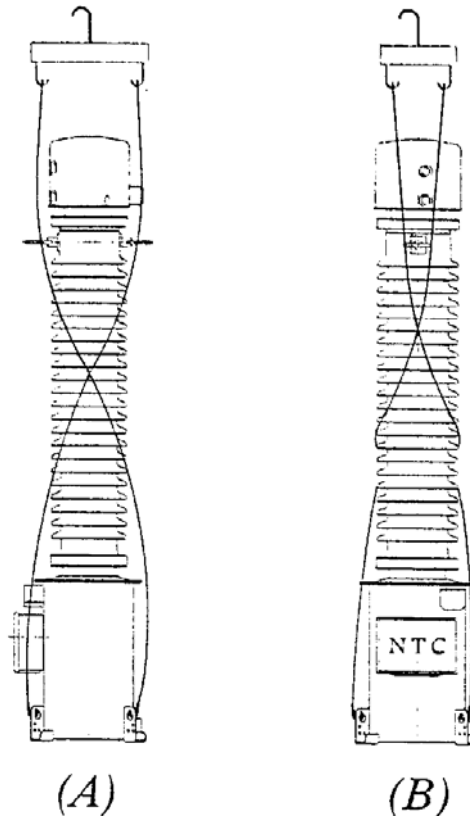


Figure No. 2

E. Storage

The storage of the transformers before installation shall be after taking them out of package. Obviously, when opening the package and taking the transformer out, it should be checked against the probable damages. Storage of all the models of IMB shall be in vertical position. Vertical positioning of the transformer is important for adjustment of the sand level.

The storage shall be on a fixed flat surface suitably of concrete and shall withstand the weight of the transformer. Since the center of gravity of the transformer is relatively low and the weight of the transformer is high, there is no need to use additional accessories for fixing the transformer to the ground.

If the transformer is to be stored more than 6 months, the storage shall be preferably in indoor space, since the inner parts of the terminal box may be susceptible to oxidization as a result of some environmental conditions.

The storage of the current transformer in humid atmosphere without correct suitable air conditioning may result in the change of color in galvanized surfaces. The change of color is known as white oxidization which mainly consists of zinc oxide and zinc hydroxide as a result of chemical reaction between pure zinc on the surfaces and moisture.



There is no need to worry about the resistance of the metallic surfaces against such a type of oxidization in long term use, because the zinc-Iron layer beneath the surface, is remained unaffected. Also, the white oxide has no had effect on the long term use of the transformer.

F. Installation

Before installation, the oil level shall be checked when the transformer is in vertical position. There are two sight glasses on the expansion tank which, in normal condition, the upper one shall be light and the lower one shall be dark. Otherwise, the sales department of Nirou Trans Co. shall be informed. It is worthnoting that the lower sight glass shall be full of oil, that is, the oil level shall not be seen in it. If the lower sight glass is light or the oil level can be seen in it, the oil level is too low and the exact leak point shall be located.

After getting confident of not leaking or any type of damage as a result of transportation and handling, put the transformer on its structure in complete vertical position. Fixing the transformer in unstable form may result in leakage. By putting metal plates, the stability of the transformer can be improved.

Tighten the bolts as long as they withstand the moment. The connections to the secondary terminals shall be done carefully. Each of the secondary windings shall be earthed in one point. The secondary windings which are not used shall be short circuited and earthed. Check the hole in the drain tube of the terminal box and get sure that it is not closed.

Never leave the secondary winding open, since very high voltage may be induced on secondary which will expose the user and the transformer to danger.

Note: If one of the taps of a secondary is in use, the others need not to and shall not be short circuited.

The connection to the primary terminals shall be so that the static force on the terminal is minimum. This is possible by using a flexible connection to the primary terminals. A solid (nonflexible) connection may lead to oil leakage in primary terminals.

To establish the connection between the current transformer and other equipment by connection cables, at first, the cables shall be connected to the other side, because of their high weights. Then the connection to the primary terminals of the current transformer can be done.

This shall be done to avoid exercising nonpermitted bending moment (figure 3 & 4). If it is appointed to connect the cable to the primary terminals of the CT at first, the fixing bolts shall be tightened completely. On the other hand, the cable shall be



supported by a stand on beneath or a rope from up, before it is connected to the other side.

If there is a height difference between the current transformer and the equipment to be connected to the CT, it is necessary to form the cable as needed. The forming of the cable shall be done before connection and it is strictly prohibited to form it after the connection to the transformer.

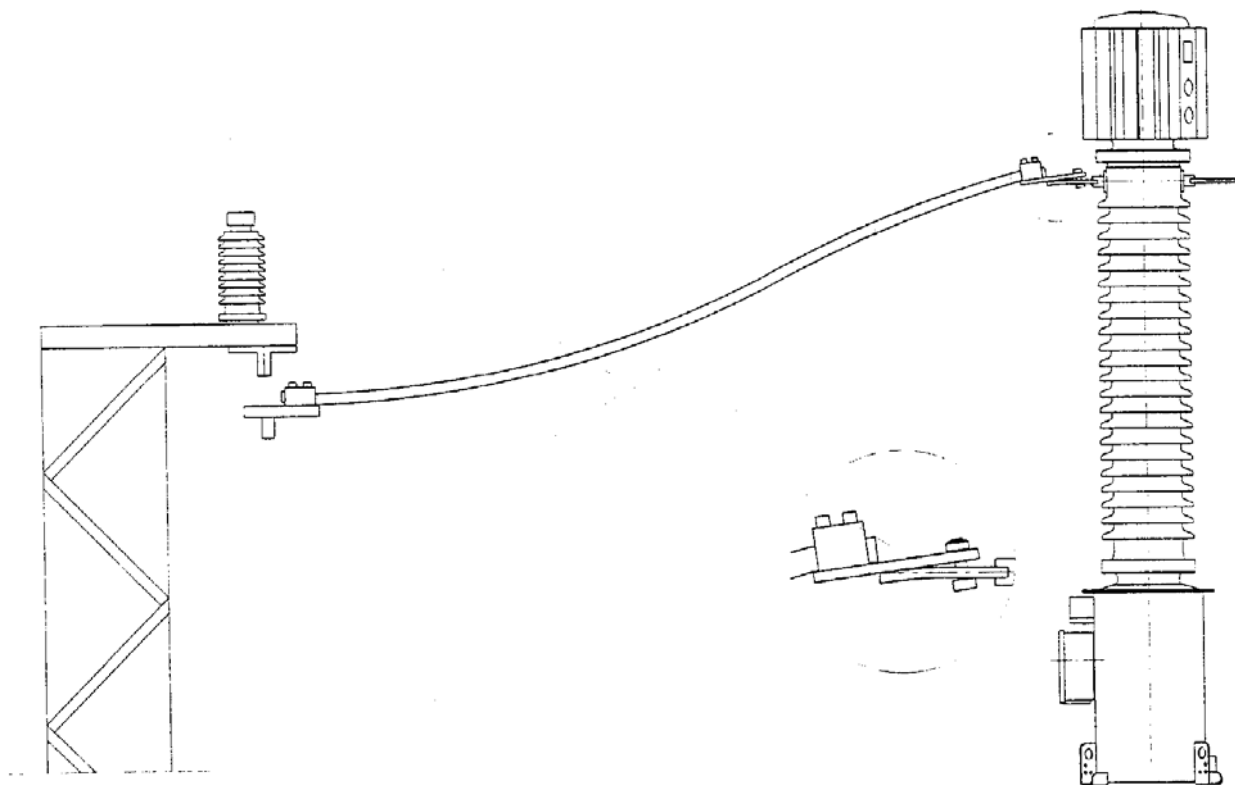


Figure No. 3

Incorrect method: Incorrect connection of cable to the primary terminal of the transformer and its release result in bending of the primary terminals.

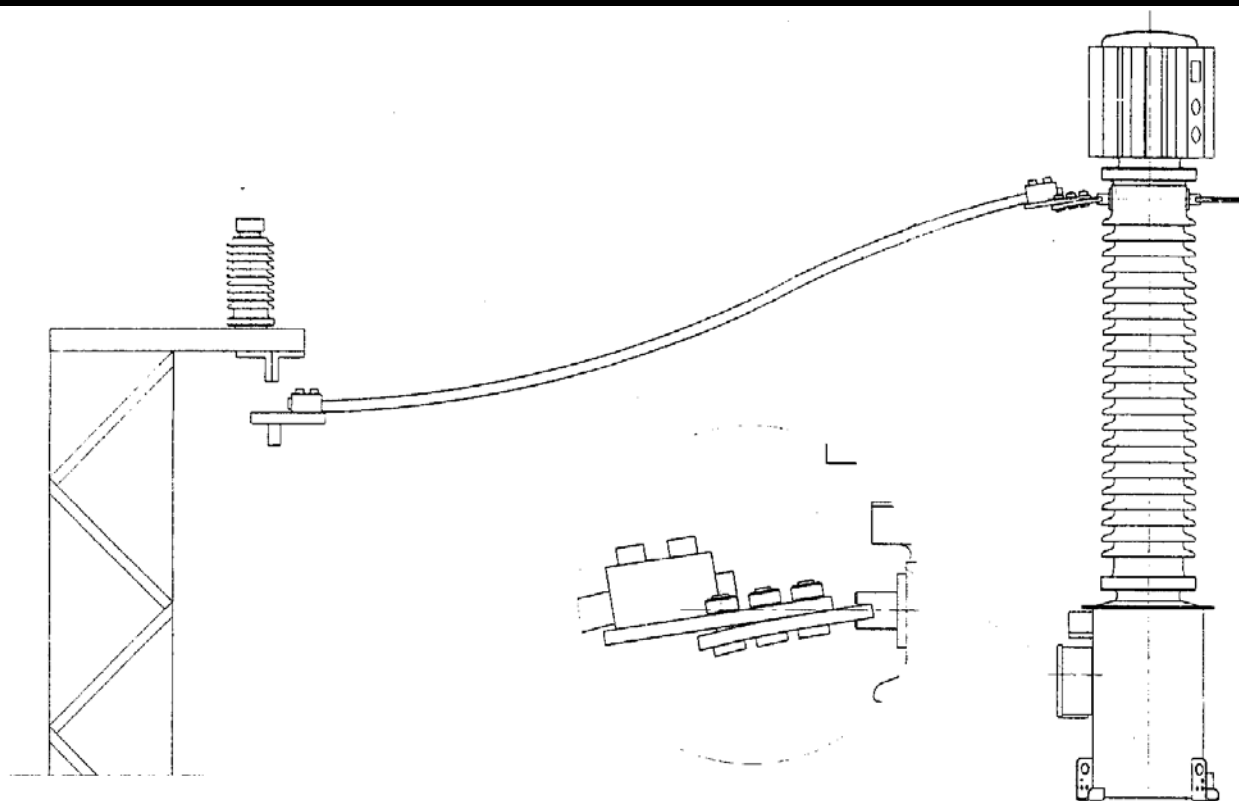


Figure No. 4

Incorrect Method: In spite of perfect connection of The cable to the primary terminal, the release of cable result in bending and breaking of the terminal.

All the connections shall be made carefully since there is a risk of temperature rise in the connections that are not tightened enough which may damage the transformer (figure No. 5).

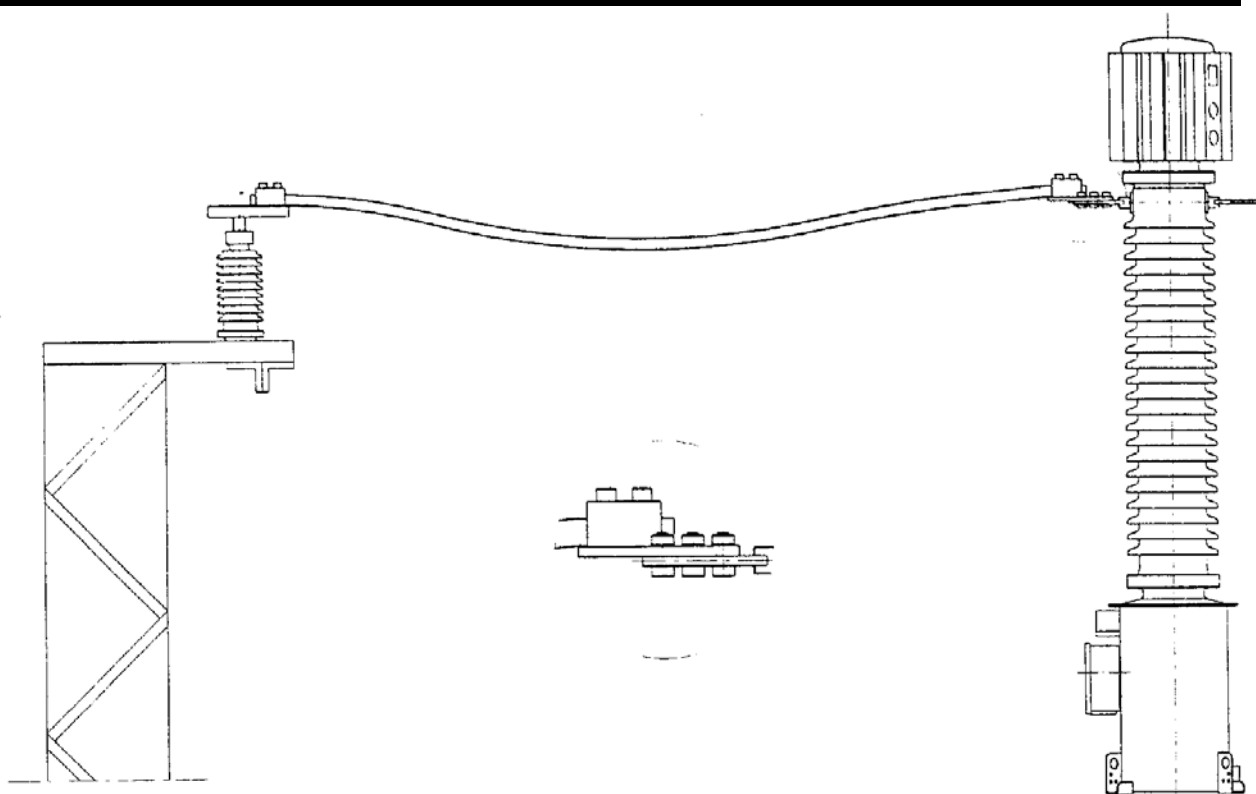


Figure No. 5

Correct Method: Perfect connection of the cable to the primary terminal after its connection to nearby equipment.

The earth terminal of the transformer is mounted on one or two corners of the oil tank and it is possible to mount them on the other corners.

Before applying voltage, the earth terminals shall be effectively earthed. The terminal of the capacitive tap (f-terminal) is brought out from the oil tank via a bushing. When not in use, it shall be connected to the oil tank.

G. Final Inspection after installation

It is recommended to check the following items again:

- Oil level
- Damage to the insulator or other parts
- The secondary terminals not to be open
- Signs of oil leakage
- Correctness of connections



H. Normal controls and maintenance

Since the transformers are hermetically sealed for air penetration, minimum maintenance is required and usually visual inspection is enough as follow: (please refer to the attached check list).

H.1. Signs of oil leakage

The following items shall be checked for any oil leakage:

- The oil sight glasses and the flange for oil filling.
- The joints between the insulator and the oil tank and the expansion tank.
- The joint between the oil tank and its cover.
- The secondary terminal box
- The capacitive tap terminal
- The flange for oil emptying (if it exists)

H.2. Damages to the transformer

Check the metal parts and insulator. Oxidations, if any, shall be so scratched that the base metal gets accessible. Then the point shall be covered with a type of color including a lot of zinc. The insulator shall be cleaned, if necessary. The damages to the sheds of the insulator, if any, can be repaired by epoxy resin. In some cases, if the repair instruction of insulator is needed, please contact the sales department of Nirou Trans Co.

H.3. Correct oil level

Necessary explanations about the point is given in, the section for installation. If there is oil leakage, the moisture may have entered the transformer.

H.4. Check of the primary terminal

H.5. Check of the secondary circuits

H.6. Check of the earth terminal

H.7. Check of the capacitive tap terminal

H.8. Oil Sampling

After a long-term operation (20 to 25 years) or after short circuits or for example after a disturbance in operation, oil can be sampled and its gas and moisture content can be controlled.



H.9. Measurement of loss angle ($\text{tg}\delta$)

The loss angle of a dielectric ($\text{tg}\delta$) is an indication of its conductivity. A good insulation has a low $\text{tg}\delta$ and conductivity and on the other side, a bad insulation has a high $\text{tg}\delta$ and any change in $\text{tg}\delta$ is a sign of a change in the insulation characteristics.

The insulating paper and its $\text{tg}\delta$ is affected by usual aging or moisture entering. In general, for an old transformer, a $\text{tg}\delta$ of up to 1.0 to 1.5 % for IMB 72, 145 kV and up to 1.0 for IMB 245 at 20°C can be considered acceptable. But, the change of $\text{tg}\delta$ is quite important, since a sudden change of it may be a sign of start of insulation deterioration.

It is recommended to measure $\text{tg}\delta$ every 3-5 years.

After 15 to 20 years or if in the last measurement, $\text{tg}\delta$ was near to limits, it is recommended to do the test each year. If ordered by the customer, the IMB transformers can include a terminal for capacitive tap which is taken out from the last but one capacitive layer in the insulation.

The terminal is normally connected to the oil tank (is earthed). After disconnecting from the oil tank, the $\text{tg}\delta$ of the last layer of insulation can be measured. The recommended voltage for the measurement is 2 to 2.5 kV rms and it shall not exceed 5 kV rms.

Attention: Before disconnecting the F-Terminal from earth, the network voltage shall be removed from the transformer and after measurement, it shall be reconnected, because the voltage on an open circuit F-terminal will be between 3 to 5 kV rms, when the nominal voltage is on primary. This may expose the operator to danger and may deteriorate the main insulation as a result of subsequent flashovers.



Attachment: Type of and plan for necessary inspections and controls

<i>Please Check</i>	<i>After opening the package</i>	<i>After installation</i>	<i>After putting in to service</i>	<i>Normal Controls</i>	<i>Annual inspection Control</i>	<i>After 15 to 20 years</i>
Damage to packing	×					
Sign of oil leakage	×	×	×			
Damage to transformer		×	×	×	×	
Correct oil level	×	×	×	×	×	
Primary connection		×			×	
Secondary circuits		×			×	
Earthing		×			×	
Secondary current			×	×	×	
Oil sample						×
Tan δ					×	×